The subject matter claimed is:

1. An actuator having a movable member that moves substantially linearly as a result of a biomolecular interaction of biologically-based components within the actuator.

2. The actuator of claim 1, wherein the movable member is coated at least in part with a first interactive biological material.

3. The actuator of claim 1, wherein the movable member is a rod.

4. The actuator of claim 1, wherein the movable member is curved.

5. The actuator of claim 2, wherein the movable member comprises nickel, palladium, gold, platinum, cobalt, permalloy, chromium, or mixtures thereof.

6. The actuator of claim 2, wherein the movable member comprises a polymeric material.

7. The actuator of claim 1 that is less than 100 microns in length in any of its 3 dimensional measurements.

8. The actuator of claim 1, wherein the biologically-based components comprise a first interactive biological material and a second interactive biological material.

9. The actuator of claim 8, wherein the first interactive biological material is a protein.

10. The actuator of claim 9, wherein each interactive biological material is a protein.

11. The actuator of claim 10, wherein the first interactive biological material is myosin and the second interactive biological material is actin.

12. The actuator of claim 10, wherein the interaction of the two interactive biological materials causes the movement of the movable member along its longitudinal axis.

13. The actuator of claim 12, wherein the longitudinal movement of the movable member is unidirectional.

14. The actuator of claim 13, wherein the longitudinal movement of the movable member is bidirectional.

15. The actuator of claim 11, wherein

two separate, parallel arrays of actin filaments are aligned along the same axis of a stationary member but with opposite polarities and both arrays are positioned to interact with myosin that is coated on the movable member; and

a separate energy-transmitting stripe is associated with each actin array in a manner to selectively energize an actin array so that when one of the stripes is sufficiently energized, the actin/myosin interaction is such that the moveable member is moved from its starting position in a direction parallel to the actin filaments within the arrays.

16. The actuator of claim 15, wherein the energy-transmitting stripe transmits heat.

17. The actuator of claim 16, wherein the movable member is a rod, the parallel actin arrays are arranged such that the actin filaments are parallel to the rod's longitudinal axis, and the rod is moved in a direction of its longitudinal axis.

18. The actuator of claim 8, wherein the interaction of the two interactive biological materials is promoted by a source of chemical potential energy.

19. The actuator of claim 18, wherein the source of chemical potential energy is a nucleoside triphosphate.

20. The actuator of claim 18, wherein the source of chemical potential energy is adenosine triphosphate (ATP) or 2'-deoxy ATP.

21. The actuator of claim 8, wherein the second interactive biological material is inert unless associated with a source of energy, wherein the energy converts the second interactive biological material into a modified energy state so that it interacts with the first biological material to cause the movable member to move relative to a starting position.

22. The actuator of claim 1 that comprises

a movable member having a biocompatible molecular layer deposited on the surface thereof and a layer of myosin, or fragment thereof, adhering to at least a portion of the biocompatible molecular layer;

at least one array of aligned actin filaments attached to a stationary member and positioned to interact with the myosin coating;

an energy-transmitting stripe associated with the actin array in a manner to energize the actin array, wherein the actin array is inert unless energized;

a well containing a substance that is a source of chemical potential energy that aids the interaction of myosin with actin, the well being positioned to retain the substance in contact with the actin array and the myosin layer; and

a hydrophobic region positioned on opposite sides of the well to slidingly engage the rod and retain the substance within the well,

wherein when the energy-transmitting stripe is sufficiently energized, the actin/myosin interaction is such that the movable member is moved in a direction parallel to the actin filaments within the array.

23. The actuator of claim 22, wherein the biocompatible molecular layer is a self-assembling monolayer.

24. The actuator of claim 22, wherein the biocompatible molecular layer is a polyelectrolyte multilayer.

25. The actuator of claim 22, wherein the movable member is a rod having a longitudinal dimension of about 100 nm to about 100 μm and a cross sectional dimension of about 5 nm to

about 200 nm.

26. The actuator of claim 25, wherein the rod is a metal chosen from the group comprising nickel, palladium, platinum, gold, cobalt, permalloy, chromium, and mixtures thereof.

27. The actuator of claim 22, wherein the biocompatible molecular layer is about 1 nm to about 200 nm in thickness.

28. The actuator of claim 22, wherein the biocompatible molecular layer circumscribes at least a portion of the length of the movable member.

29. The actuator of claim 22, wherein the myosin comprises a myosin S1 unit or a heavy meromyosin unit.

30. The actuator of claim 22, wherein the energy-transmitting stripe associated with the actin array is platinum, nickel or gold.

31. The actuator of claim 30, wherein the energy-transmitting stripe is about 10 nm to about 250 nm thick and at least 10 nm wide.

32. The actuator of claim 22, wherein the substance that is the source of potential chemical energy is a nucleoside triphosphate.

33. The actuator of claim 32, wherein the nucleoside triphosphate is adenosine triphosphate (ATP) or 2'-deoxy ATP.

34. The actuator of claim 22, wherein the movable member is a rod having a gold surface and the biocompatible molecular layer comprises a protein or peptide or a compound with the formula R^1SH, R^1SSR^2, R^1SR^2, R^1SO_2H, $(R^1)_3P$, R^1NC, R^1CN, $(R^1)_3N$, R^1COOH, or ArSH, wherein:

R^1 and R^2 each has the formula $X(CH_2)_n$ and, if a compound is substituted with

both R^1 and R^2, then R^1 and R^2 are the same or different;

n is 0-30;

Ar is an aryl;

X is $-CH_3$, $-CHCH_3$, -COOH, $-CO_2(CH_2)_m$-OH, $-CH_2OH$, ethylene glycol, hexa (ethylene glycol), $-O(CH_2)_mCH_3$, $-NH_2$, $-NH(CH_2)_mNH_2$, halogen, glucose, maltose, fullerene C60, a nucleic acid, a protein, or a ligand; and

m is 0-30.

35. The actuator of claim 34, wherein the compound has the formula R^1SH or ArSH.

36. The actuator of claim 35, wherein the compound is propanedithiol, hexanedithiol, octanedithiol, n-hexadecanethiol, n-docosanethiol, 11-mercapto-1-undecanol, α,α-p-xylyldithiol, 4,4'-biphenyldithiol, terphenyldithiol, or DNA-alkanethiol.

37. The actuator of claim 1, wherein the movable member is a rod having a surface of aluminum, gallium arsenide or titanium dioxide and a biocompatible molecular layer is deposited on the surface, wherein the biocompatible molecular layer comprises a compound with the formula R^1SH or R^1SiCl_3, wherein

R^1 has the formula $X(CH_2)_n$;

n is 0-30;

X is $-CH_3$, $-CHCH_3$, -COOH, $-CO_2(CH_2)_mCH_3$, -OH, -CH2OH, ethylene glycol, hexa(ethylene) glycol, $-O(CH_2)_mCH_3$, $-NH_2$, $-NH(CH_2)_mNH_2$, halogen, glucose, maltose, fullerene C60, a nucleic acid, a protein, or a ligand; and

m is 0-30.

38. The actuator of claim 22, wherein the movable member is a rod having a surface of silicon dioxide and the compound is a protein or peptide or has the formula R^1SH or R^1SiCl_3, wherein:

R^1 has the formula $X(CH_2)_n$;

n is 0-30.

X is $-CH_3$, $-CHCH_3$, -COOH, $-CO_2(CH_2)_mCH_3$, -OH, $-CH_2OH$, ethylene glycol,

hexa(ethylene glycol), $-O(CH_2)_mCH_3$, $-NH_2$, $-NH(CH_2)_mNH_2$, halogen, glucose, maltose, fullerene C60, a nucleic acid, a protein, or a ligand; and

m is 0-30.

39. A device that comprises

an actuator having a movable member that moves substantially linearly as a result of biomolecular interaction of biologically-based components within the actuator;

an orifice,

wherein the actuator is position relative to the orifice such that the movable member in the closed position blocks the orifice but clears the orifice when the biomolecular interaction of biologically-based components within the actuator cause the member to move to an open position.

40. The device of claim 39, further comprising

a reservoir for containing a fluid,

wherein the orifice is an exit orifice from the reservoir, and

wherein the actuator is positioned between the reservoir and the exit orifice such that the movable member in a closed position blocks the flow of fluid from the reservoir to the exit orifice but allows fluid to flow when the biomolecular interaction of the biologically-based components within the actuator cause the member to move to an open position.

41. The device of claim 39 further comprising a radiation source producing electromagnetic radiation wherein the actuator is positioned between the radiation source and the orifice such that the movable member in a closed position blocks the flow of electromagnetic radiation through the orifice but allows the electromagnetic radiation to pass when the biomolecular interaction of the biologically-based components within the actuator cause the member to move to an open position.

42. A member having a biocompatible molecular layer deposited on the surface of the member and a layer of a protein or fragment thereof that aids in the contraction or relaxation of muscle adhering to at least a portion of the biocompatible molecular layer.

43. The member of claim 42, wherein the member is a rod.

44. The rod of claim 43 wherein the protein is myosin, myosin S1, or heavy meromyosin.

45. The rod of claim 43, wherein the rod's longitudinal dimension is about 100 nanometers (nm) to about 100 microns and the rod's cross sectional dimension is about 5 nm to about 200 nm.

46. The rod of claim 43, wherein the rod is a metal chosen from the group comprising nickel, palladium, platinum, gold, cobalt, permalloy, chromium and mixtures thereof.

47. The rod of claim 43, wherein the rod comprises a polymeric material.

48. The rod of claim 43, wherein the biocompatible molecular layer is about 1 nm to about 200 nm in thickness.

49. The rod of claim 43, wherein the biocompatible molecular layer circumscribes at least a portion of the length of the rod.

50. The rod of claim 43, wherein the biocompatible molecular layer comprises a protein or peptide or a compound with the formula R^1SH, R^1SSR^2, R^1SR^2, R^1SO_2H, $(R^1)_3P$, R^1NC, R^1CN, $(R^1)_3N$, R^1COOH, or ArSH, wherein:

R^1 and R^2 each has the formula $X(CH_2)_n$ and, if a compound is substituted with both R^1 and R^2, then R^1 and R^2 are the same or different;

n is 0-30;

Ar is an aryl;

X is $-CH_3$, $-CHCH_3$, -COOH, $-CO_2(CH_2)_m$-OH, $-CH_2OH$, ethylene glycol, hexa (ethylene glycol), $-O(CH_2)_mCH_3$, $-NH_2$, $-NH(CH_2)_mNH_2$, halogen, glucose, maltose, fullerene C60, a nucleic acid, a protein, or a ligand; and

m is 0-30.

51. The rod of claim 43, wherein the biocompatible molecular layer comprises a compound with the formula R^1SH or R^1SiCl_3, wherein

R^1 has the formula $X(CH_2)_n$;

n is 0-30;

X is $-CH_3$, $-CHCH_3$, -COOH, $-CO_2(CH_2)_mCH_3$, -OH, -CH2OH, ethylene glycol, hexa(ethylene) glycol, $-O(CH_2)_mCH_3$, $-NH_2$, $-NH(CH_2)_mNH_2$, halogen, glucose, maltose, fullerene C60, a nucleic acid, a protein, or a ligand; and

m is 0-30.

52. A process for making the member of claim 42, which process comprises depositing a biocompatible molecular layer on the surface of a member and adhering a layer the protein, or fragment thereof, onto the biocompatible molecular layer.

53. The process of claim 52, wherein the member is a rod and the rod's longitudinal dimension is about 100 nm to about 100 microns and the rod's cross sectional dimension is about 5 nm to about 200 nm.

54. The process of claim 53, wherein the biocompatible molecular layer is deposited on the rod using a dip-pen nanolithography technique.

55. The process of claim 54, wherein the biocompatible molecular layer is about 1 nm to about 200 nm in thickness.

56. The process of claim 52, wherein the biocompatible molecular layer circumscribes at least a portion of the length of the rod.

57. A well structure for use in the biomolecular-based actuator of claim 1, which structure comprises

at least one array of protein filaments positioned to interact with a protein coat on a movable member having a biocompatible molecular layer deposited on the surface of

the member, where the protein coat adheres to at least a portion of the biocompatible molecular layer;

an energy-transmitting stripe associated with the array in a manner to selectively energize the array;

a well containing a substance of chemical potential energy that aids the interaction of the protein coat on the movable member with the array, the well being positioned to retain the substance in contact with the array and the protein coat; and

a hydrophobic region positioned on opposite sides of the well to slidingly engage the movable member and retain the substance within the well.

58. The well structure of claim 57, wherein the energy-transmitting stripe is platinum, nickel or gold.

59. The well structure of claim 57, wherein the energy-transmitting stripe is about 10 nm to about 250 nm thick and at least about 10 nm wide.

60. The well structure of claim 57, wherein the substance is adenosine triphosphate (ATP) or 2'-deoxy ATP.

61. The well structure of claim 57, wherein

the movable member is a rod;

the array is an array of actin filaments;

the protein coat comprises myosin, myosin S1, or heavy meromyosin;

two separate parallel arrays of actin filaments are aligned along the same axis but with opposite polarities, each array of actin filaments being aligned parallel to the longitudinal axis of the rod and positioned to interact with the myosin coating; and

a separate energy-transmitting stripe associated with each array of actin filaments in a manner to selectively energize an actin filament array so that when one of the energy-transmitting stripes is sufficiently energized, the actin/myosin interaction is such that the rod is moved along its longitudinal axis from its starting position in a direction parallel to the actin filament array.

62. The well structure of claim 61, wherein the stripe is a heater stripe.

63. The well structure of claim 62, wherein

the parallel arrays of actin filaments are positioned such that the actin filaments within the arrays are parallel to the longitudinal axis of the rod.

64. A process for making the well structure of claim 57, which process comprises

providing a reservoir having an inside surface and two orifices positioned opposite each other and suitable for receiving a movable member through each orifice;

positioning at least one array of a protein on the inside surface of the reservoir;

positioning an energy-transmitting stripe in contact with the array so that the end of the stripe away from the protein array may be connected to an energy source; and

providing a hydrophobic region at each orifice to slidingly engage a movable member through each orifice and provide a seal for aqueous liquid when placed in the reservoir.

65. The process of claim 64, wherein the array of a protein is an array of actin filaments.

66. The process of claim 65, wherein two separate, parallel arrays of actin filaments are aligned along the same axis but with opposite polarities and are positioned on the inside surface of the reservoir but spaced from each other, and a separate energy-transmitting stripe contacts each array in a way to selectively energize an actin filament array.

67. The process of claim 65, wherein the energy-transmitting stripe is platinum, nickel or gold.

68. The process of claim 66, wherein the parallel arrays of actin filaments are positioned to be parallel to the longitudinal axis of a movable member that would be positioned through each orifice.

69. A process for preparing an actuator of claim 1, which process comprises

providing a movable member;

depositing a first protein that aids in the contraction or relaxation of muscle on at least a portion of the surface of the movable member;

providing a reservoir having (a) an inner surface having an array of a second protein that interacts with the first protein deposited on the inner surface, (b) an energy-transmitting strip contacting the second protein so that the end of the stripe away from the array can be connected to an energy source, and (c) two orifices opposite each other to receive the movable member so that the first protein can be positioned within the reservoir; and

providing a substance that is a source of potential chemical energy to aid in the interaction of the first and second proteins,

wherein, when energy is transmitted to the second protein the movable member moves from a starting position to a different position.

70. The process of claim 69, wherein the movable member is a rod having a biocompatible molecular layer deposited thereon.

71. The process of claim 70, wherein the first protein is myosin, or a fragment thereof, the second protein is actin, and the source of potential chemical energy is ATP or 2'-deoxy ATP.

72. The process of claim 71, wherein a hydrophobic region is positioned at each orifice to aid in retaining the ATP or 2'-deoxy ATP within the reservoir.

73. The process of claim 72, wherein the hydrophobic region is a collar that is positioned around the rod.

74. A combination of a Hall gradiometer with an actuator having a movable member that moves as a result of biomolecular interaction of a biologically-based components within the actuator.

75. The combination of claim 74, wherein the movable member has a magnetic field associated with it so that the motion of the movable member is detected by measuring the fringe magnetic field of the movable member in the gradiometer.

76. The combination of claim 74, wherein the combination operates at a temperature of about 0°C to about 70°C.

77. The combination of claim 74, wherein the dimensions of the combination are less than about a centimeter in any dimension.

78. The combination of claim 74, that is interactively connected to at least one other combination.

79. The combination of claim 74, that incorporates a feed back mechanism between the gradiometer and the actuator, which feed back mechanism can change the length of motion of the movable member.

80. The combination of claim 74, combined with a fluid-containing reservoir, wherein the movable member acts as a valve to release a fluid from the reservoir.

81. A combination of at least two actuators of claim 1, wherein the actuators function in concert.